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STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
MISLEH, JUSTIN P	

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2612	4

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/768,454	FUKUYOSHI ET AL.
	Examiner	Art Unit
	Justin P Misleh	2612

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1 - 15_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1 - 15_ is/are rejected.

7)☒ Claim(s) _1,3,7 and 8_ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _25 January 2001_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _3_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: typographical errors.

On page 11 (lines 4, 5, 24, and 26), the Applicant states: "resin lens 21". However, Figure 2 shows "resin lens 21c". On page 20 (line 7), the Applicant states: "ditch 21". However, Figures 2 and 3B show "ditch 22".

Appropriate correction is required.

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

3. **Claims 1, 3, 7, and 8** are objected to because of the following informalities: antecedent basis issue.

For **Claim 1**, page 29 (line 5) recites, "said micro lens array", however, the Applicant only claims "a lens array". The lack of antecedent basis is evident in the above citation. **Claim 7** presents a similar issue. Furthermore, the issue is translated in **Claims 3 and 8**, respectively.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1 – 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Isokawa (JP 05-145813 A) in view of Naka et al. The Isokawa reference is a published Japanese Patent Application (11 June 1993). An English language Abstract as well as an English language computer translation of Isokawa have been provided by the Examiner and will be used as a basis for the following rejections.

6. For **Claim 1** (see objection above), Isokawa discloses, as shown in figures 2 and 3 and as stated in paragraphs 0009 – 0016, a solid-state image pickup device (1), comprising:

a lens array (3) formed by arranging a plurality of resin (see paragraph 0009) lenses (see **Point A** below);

an undercoat layer (flat layer 2) for fixing said lens array (3; see **Point B** below) and having a ditch (6) formed between said adjacent resin lenses (3; as clearly shown in figure 3; also see **Point C** below); and

a transparent layer (transparent membrane 4) covering said plural resin lenses (2) with substantially the same thickness and the ditch between said adjacent resin lenses (see **Point D** below).

As clearly stated by Isokawa in the **Points** below, the aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent membrane/oxide film (4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6)

distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

While Isokawa discloses a plurality of resin lenses (3) and a transparent layer (4) covering said plurality of resin lenses (3), wherein the transparent layer (4) is formed "at the temperature below the heat softening temperature of the transparence resin ingredient" (e.g. Light CVD and plasma CVD), Isokawa does not disclose wherein the transparent layer (4) is a transparent resin layer.

However, Naka et al. also discloses a solid-state image pickup device comprising a plurality of resin lenses. More specifically, Naka et al. disclose, as shown in figure 4 and as stated in column 5 (lines 15 – 33), a solid-state image pickup device (6) comprised of a plurality of resin lenses (28) and a transparent resin layer (44) covering the plurality of resin lenses (28). For support, Naka et al. states, "A resin layer 44 of a given thickness is formed over the microlenses 28." Finally, as stated in column1 (lines 43 – 51), at the time the invention was made, one with ordinary skill in the art would have motivated to include a transparent resin layer for covering the plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa, as a means to increase the light converging effect of the plurality of resin lenses. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to have included a transparent resin layer for covering the plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa.

Points

A. Isokawa discloses a lens array (3) formed by arranging a plurality of resin lenses (according to the drawings; at least 2 lenses in a linear arranging direction); however, Isokawa is silent with regard to arranging the plurality of resin lenses in a manner to form a matrix. Isokawa gives no indication that the disclosure is limited to strictly a one-dimensional solid-image pickup device or a two-dimensional solid-image pickup device. Therefore, since a two-dimensional solid-image pickup device is well known and expected in the art and furthermore, a two-dimensional solid-image pickup device captures an image with exceedingly more detail than a one-dimensional solid-image pickup device, it would have been obvious for Isokawa to provide a two-dimensional solid-state image pickup device.

B. Isokawa states in paragraph 0009, "Subsequently, on this flat layer 2, it is optically transparent similarly as a lens layer, and after forming the resin ingredient layer of a heat softening mold by revolution spreading, the usual photolithography technique performs patterning corresponding to a light sensing portion, and a transparence resin layer pattern is formed on a light sensing portion. Subsequently, the periphery of a transparence resin layer pattern is produced for whom in heat treatment by the temperature more than heat softening temperature, and the convex lens-like substrate micro lens 3 is formed."

C. Isokawa states in paragraph 0014, "Under the present circumstances, the gap G between lenses is too set to about 1.0 micrometers similarly. Subsequently, it etches until the gap G between lenses disappears under the conditions which the selection ratio of the flat layer 2 and the substrate micro lens 3 becomes one by the dry etching methods, such as reactive ion etching (R-I-E) generally used at the semi-conductor etching process, as shown in drawing 3."

D. Isokawa states in paragraph 0010, "Next, as shown in (B) of drawing 1, about **0.5-micrometer thickness** extent deposition of the **optical transparent membrane 4** which can be formed at the temperature below the heat softening temperature of the transparence resin". Furthermore, Isokawa states in paragraph 0012, "Then, as shown in drawing 2, perform revolution spreading using the spin-on glass (SOG) used for flattening of the interlayer insulation film of a semi-conductor etc., it is made to sinter at the temperature below the heat softening temperature of a lens resin ingredient, and an **oxide film 5** is obtained. Drawing 2 shows the lens configuration after carrying out deposition formation of the oxide film 5 by SOG on the substrate micro lens 3 in this way. According to this approach, the gap section produced conventionally disappears mostly and the micro lens of the rate of high condensing can form easily." Finally, Isokawa states in paragraph 0013, "In order to form an oxide film 5 by revolution spreading on the substrate micro lens 3 so that this drawing 2 may show, an oxide film 5 does not turn into isotropic membrane formation, but the thickness **TOX2 of the oxide film 5 formed in the gap section between lenses is thick**, and the thickness **TOX1 of the oxide film 5 formed in the crowning of the substrate micro lens 3 has the membrane formation property which becomes thin**. Thereby, the curvature of a final micro lens becomes larger than the substrate micro lens 3.

7. As for **Claim 2**, referring back to parent Claim 1, it was shown that while Isokawa discloses a one-dimensional lens array (3), it would have been obvious for Isokawa to have included a two-dimensional lens array. Furthermore, Isokawa discloses that the transparent layer (4) covering the plurality of lenses (3) is of uniform thickness (0.5 micrometers) wherein due the distance between adjacent lenses (1.0 micrometer) the transparent layer (4) in the gaps is evidently becomes thicker than the on top of the lenses (3), as clearly shown in figure 2.

Claim 2 requires that "wherein the minimum thickness of said transparent resin layer in the ditch between said adjacent resin lenses in the diagonal direction of said lens array is smaller than the minimum thickness of said transparent resin layer in the ditch between adjacent resin lenses in the arranging direction of said lens array." With the above interpretations of Isokawa being said, Claim 2 is a naturally occurring feature of a two-dimensional lens array with a uniform thickness transparent layer, as will become evident. Since the two arranging directions (X/Y or horizontal/vertical) of the two-dimensional lens array are perpendicular to each other, the diagonal distance across the entire lens array is naturally greater than each of the two arranging directions. According to Pythagorean's theorem, the diagonal distance D is related to each of the arranging direction distances (A and B) by the following equation: $\sqrt{(A^2 + B^2)}$. Thus, for the same reason that the transparent layer (4) in the gaps in the arranging directions evidently becomes thicker than the on top of the lenses (3), the transparent layer (4) in the gaps in the diagonal direction evidently becomes thinner than the on top of the lenses (3). Thus, Isokawa naturally meets the requirements of Claim 2.

8. For **Claim 7** (see objection above), Isokawa discloses, as shown in figures 2 and 3 and as stated in paragraphs 0009 – 0016, a solid-state image pickup device (1), comprising:

a lens array (3) formed by arranging a plurality of resin (see paragraph 0009) lenses (see **Point A** below);

an undercoat layer (flat layer 2) for fixing said lens array (3; see **Point B** below) and having a ditch (6) formed between said adjacent resin lenses (3; as clearly shown in figure 3; also see **Point C** below); and

a transparent layer (transparent membrane 4) covering said plural resin lenses (2) with substantially the same thickness and the ditch between said adjacent resin lenses (see **Point D** below),

wherein the difference between the height of the surface of said transparent layer in the ditch in the diagonal direction of said lens array and the height of the tops of micro lenses each consisting of said resin lens and said transparent resin layer covering the surface of said resin lens is larger than the difference between the height of the surface of said transparent layer in the ditch in the arranging direction of said lens array and the height of the top of the micro lens (see **Point E** below).

As clearly stated by Isokawa in the **Points** below, the aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent membrane/oxide film (4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6) distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of

the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

While Isokawa discloses a plurality of resin lenses (3) and a transparent layer (4) covering said plurality of resin lenses (3), wherein the transparent layer (4) is formed "at the temperature below the heat softening temperature of the transparence resin ingredient" (e.g. Light CVD and plasma CVD), Isokawa does not disclose wherein the transparent layer (4) is a transparent resin layer.

However, Naka et al. also discloses a solid-state image pickup device comprising a plurality of resin lenses. More specifically, Naka et al. disclose, as shown in figure 4 and as stated in column 5 (lines 15 – 33), a solid-state image pickup device (6) comprised of a plurality of resin lenses (28) and a transparent resin layer (44) covering the plurality of resin lenses (28). For support, Naka et al. states, "A resin layer 44 of a given thickness is formed over the microlenses 28." Finally, as stated in column1 (lines 43 – 51), at the time the invention was made, one with ordinary skill in the art would have motivated to include a transparent resin layer for covering the plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa, as a means to increase the light converging effect of the plurality of resin lenses. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to have included a transparent resin layer for covering the plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa.

Points

A. Isokawa discloses a lens array (3) formed by arranging a plurality of resin lenses (according to the drawings; at least 2 lenses in a linear arranging direction); however, Isokawa is silent with regard to arranging the plurality of resin lenses in a manner to form a matrix. Isokawa gives no indication that the disclosure is limited to strictly a one-dimensional solid-image pickup device or a two-dimensional solid-image pickup device. Therefore, since a two-dimensional solid-image pickup device is well known and expected in the art and furthermore, a two-dimensional solid-image pickup device captures an image with exceedingly more detail than a one-dimensional solid-image pickup device, it would have been obvious for Isokawa to provide a two-dimensional solid-state image pickup device.

B. Isokawa states in paragraph 0009, "Subsequently, on this flat layer 2, it is optically transparent similarly as a lens layer, and after forming the resin ingredient layer of a heat softening mold by revolution spreading, the usual photolithography technique performs patterning corresponding to a light sensing portion, and a transparence resin layer pattern is formed on a light sensing portion. Subsequently, the periphery of a transparence resin layer pattern is produced for whom in heat treatment by the temperature more than heat softening temperature, and the convex lens-like substrate micro lens 3 is formed."

C. Isokawa states in paragraph 0014, "Under the present circumstances, the gap G between lenses is too set to about 1.0 micrometers similarly. Subsequently, it etches until the gap G between lenses disappears under the conditions which the selection ratio of the flat layer 2 and the substrate micro lens 3 becomes one by the dry etching methods, such as reactive ion etching (R-I-E) generally used at the semi-conductor etching process, as shown in drawing 3."

D. Isokawa states in paragraph 0010, "Next, as shown in (B) of drawing 1, about **0.5-micrometer thickness** extent deposition of the **optical transparent membrane 4** which can be formed at the temperature below the heat softening temperature of the transparence resin". Furthermore, Isokawa states in paragraph 0012, "Then, as shown in drawing 2, perform revolution spreading using the spin-on glass (SOG) used for flattening of the interlayer insulation film of a semi-conductor etc., it is made to sinter at the temperature below the heat softening temperature of a lens resin ingredient, and an **oxide film 5** is obtained. Drawing 2 shows the lens configuration after carrying out deposition formation of the oxide film 5 by SOG on the substrate micro lens 3 in this way. According to this approach, the gap section produced conventionally disappears mostly and the micro lens of the rate of high condensing can form easily." Finally, Isokawa states in paragraph 0013, "In order to form an oxide film 5 by revolution spreading on the substrate micro lens 3 so that this drawing 2 may show, an oxide film 5 does not turn into isotropic membrane formation, but the thickness **TOX2 of the oxide film 5 formed in the gap section between lenses is thick**, and the thickness **TOX1 of the oxide film 5 formed in the crowning of the substrate micro lens 3 has the membrane formation property which becomes thin**. Thereby, the curvature of a final micro lens becomes larger than the substrate micro lens 3.

E. It was shown that while Isokawa discloses a one-dimensional lens array (3), it would have been obvious for Isokawa to have included a two-dimensional lens array. Furthermore, Isokawa discloses that the transparent layer (4) covering the plurality of lenses (3) is of uniform thickness (0.5 micrometers) wherein due the distance between adjacent lenses (1.0 micrometer) the transparent layer (4) in the gaps is evidently becomes thicker than the on top of the lenses (3), as clearly shown in figure 2.

With the above interpretations of Isokawa being said, this limitation in Claim 7 is a naturally occurring feature of a two-dimensional lens array with a uniform thickness transparent layer, as will become evident. Since the two arranging directions (X/Y or horizontal/vertical) of the two-dimensional lens array are perpendicular to each other, the diagonal distance across the entire lens array is naturally greater than each of the two arranging directions. According to Pythagorean's theorem, the diagonal distance D is related to each of the arranging direction distances (A and B) by the following equation: $\sqrt{}\,(A^2 + B^2)$. Thus, for the same reason that the transparent layer (4) in the gaps in the arranging directions evidently becomes thicker than the on top of the lenses (3), the transparent layer (4) in the gaps in the diagonal direction evidently becomes thinner than the on top of the lenses (3). Thus, Isokawa naturally meets the requirements this limitation in Claim 7.

9. As for **Claims 4 and 9**, Isokawa discloses that the transparent layer (4) covering the plurality of lenses (3) is of uniform thickness (0.5 micrometers). The aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent

membrane/oxide film (4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6) distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

Although, Isokawa does not specify a ditch depth, it is apparent that the ditch depth is at least 0.5 micrometers to avoid an unduly thickening of the transparent layer, wherein 0.5 micrometers meets the ditch depth requirement range of 0.05 micrometers and 1.5 micrometers.

Furthermore, it clear that the uniform thickness (0.5 micrometers) of the transparent layer (4) is outside the required range of 0.01 micrometers and 0.3 micrometers. According to the pages 11 – 14 of the specification, the required range of 0.01 micrometers and 0.3 micrometers is preferable because it allows easy formation of the transparent layer (4) over the lenses (3) and it reduces costs in manufacturing.

Isokawa discloses a method of manufacturing that allows for an easy formation of the transparent layer (4) as indicated in paragraph 0005: "Although condensing capacity is acquired by forming, in order to raise the rate of condensing by the micro lens more, it is required to make smaller the gap G between each lens shown in drawing 6 … even if a gap G is small, it is needed about 0.8 micrometers with the constraint at the time of forming the sun-lit layer pattern for micro-lens formation with a photolithography technique … configuration control in case it being stabilized and forming a tooth space on the resolution at the time of photolithography about the gap of 0.8 micrometers or less to the sun-lit layer which is a **lens ingredient makes whom of**

the pattern circumference difficult carry out and **according to heat treatment more than subsequent heat softening temperature generated is dramatically difficult** ... This invention was made in order to cancel the above-mentioned trouble in the manufacture approach of the conventional micro lens, and it aims at offering the manufacture approach of the micro lens for solid state image pickup devices which the gap between lenses was vanished and made the rate of condensing high more."

Since the method of Isokawa is also designed for ease in formation of the entire device including the transparent layer, which is the same aim as the Applicant, the Examiner believes the required range (0.01 micrometers and 0.3 micrometers) is a matter of design of choice by the Applicant. Finally, the Examiner believes low cost manufacturing is an inherent objective of engineering.

10. As for **Claims 5 and 10**, the Applicant states in the specification on page 22, "Also it is desirable to select a resin of the undercoat layer 17 having an **etching rate higher than** (for example, about three times) that of the base material of the resin lens 21b for forming the undercoat layer 17. **This selection is in order to retain the shape of the resin lens 21b."**

The aim of Isokawa is also to offer "the manufacture approach of the micro lens for solid state image pickup devices which the gap between lenses was vanished and **made the rate of condensing high more**." To make "the rate of condensing high more", it is imperative that the resin lenses (3) retain their shape. Similarly, Isokawa discloses a resin undercoat layer (2) and resin lenses (3).

Isokawa is silent with respect to the rate of the etching; however, since Isokawa accomplishes the same aim as the Applicant by not specifying an etching rate, the Examiner believes that the Applicant's choice of etching rate is merely a design preference.

11. For **Claim 12** (see objection above), Isokawa discloses, as shown in figures 2 and 3 and as stated in paragraphs 0009 – 0016, a method of manufacturing a solid-state image pickup device (1), comprising the steps of:

forming a photosensitive resin layer (3) on an undercoat layer (flat layer 2; see **Point A** below);

exposing said photosensitive resin layer (3) to light in a predetermined pattern (photolithography), followed by a developing treatment so as to form a resin pattern layer (3) having a predetermined gap width (gaps 6 have a 1.0 micrometer gap width; see **Point A** below); and

subjecting said resin pattern layer (3) to a heat flow so as to form a resin lens array which is arranged a plurality of resin (see paragraph 0009) lenses (3; see **Point B** below);

applying an etching treatment to those potions of said undercoat layer (2) which are exposed in regions between adjacent resin lenses to form ditches (6; see **Point C** below); and

forming a transparent layer (transparent membrane 4) on the surfaces of said resin lenses (3) and said undercoat layer (flat layer 2; see **Point D** below).

As clearly stated by Isokawa in the **Points** below, the aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent membrane/oxide film

(4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6) distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

While Isokawa discloses a plurality of resin lenses (3) and a transparent layer (4) covering said plurality of resin lenses (3), wherein the transparent layer (4) is formed "at the temperature below the heat softening temperature of the transparence resin ingredient" (e.g. Light CVD and plasma CVD), Isokawa does not disclose wherein the transparent layer (4) is a transparent resin layer.

However, Naka et al. also discloses a solid-state image pickup device comprising a plurality of resin lenses. More specifically, Naka et al. disclose, as shown in figure 4 and as stated in column 5 (lines 15 – 33), a solid-state image pickup device (6) comprised of a plurality of resin lenses (28) and a transparent resin layer (44) covering the plurality of resin lenses (28). For support, Naka et al. states, "A resin layer 44 of a given thickness is formed over the microlenses 28." Finally, as stated in column1 (lines 43 – 51), at the time the invention was made, one with ordinary skill in the art would have motivated to include a transparent resin layer for covering the plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa, as a means to increase the light converging effect of the plurality of resin lenses. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to have included a transparent resin layer for covering the

plurality of resin lenses, as taught by Naka et al., in the solid-state image pickup device, disclosed by Isokawa.

Points

A. Isokawa states in paragraph 0009, "As shown in (A) of drawing 1, on the solid state image pickup device 1 first equipped with a light sensing portion, the transfer section, etc., a transparent resin ingredient ... PGMA etc., is optically applied by revolution spreading, and the flat layer 2 is formed at desired thickness. Subsequently, on this flat layer 2, it is optically transparent similarly as a lens layer, and after forming the resin ingredient layer of a heat softening mold by revolution spreading, the usual photolithography technique performs patterning corresponding to a light sensing portion, and a transparence resin layer pattern is formed on a light sensing portion. Subsequently, the periphery of a transparence resin layer pattern is produced for whom in heat treatment by the temperature more than heat softening temperature, and the convex lens-like substrate micro lens 3 is formed. Under the present circumstances, setting the gap G between lenses can be kept at the time of the photolithography of the transparence resin layer pattern used as a lens, it corresponds to a tooth space, and resolution sets it to about 1.0 micrometers obtained easily."

B. Isokawa discloses a lens array (3) formed by arranging a plurality of resin lenses (according to the drawings; at least 2 lenses in a linear arranging direction); however, Isokawa is silent with regard to arranging the plurality of resin lenses in a manner to form a matrix. Isokawa gives no indication that the disclosure is limited to strictly a one-dimensional solid-image pickup device or a two-dimensional solid-image pickup device. Therefore, since a two-

dimensional solid-image pickup device is well known and expected in the art and furthermore, a two-dimensional solid-image pickup device captures an image with exceedingly more detail than a one-dimensional solid-image pickup device, it would have been obvious for Isokawa to provide a two-dimensional solid-state image pickup device.

C. Isokawa states in paragraphs 0014 and 0015, "Under the present circumstances, the gap G between lenses is too set to about 1.0 micrometers similarly. Subsequently, it **etches** until the gap G between lenses disappears under the conditions which the selection ratio of the flat layer 2 and the substrate micro lens 3 becomes one by the dry etching methods, such as **reactive ion etching (R-I-E)** generally used at the **semi-conductor etching** process, as shown in drawing 3. Under the present circumstances, with the configuration of the substrate micro lens 3, on a lens front face, the **etching kind** which carried out incidence near a lens … and the gap section receives the ion dispersion 6, as shown in drawing 3, and the increase of the amount of **etching** of only the gap section and the micro lens 7 formed eventually serve as the configuration where the gap disappeared, as a result. Therefore, also by this approach, the gap section can form easily the high condensing micro lens which disappeared mostly."

D. Isokawa states in paragraph 0010, "Next, as shown in (B) of drawing 1, about **0.5-micrometer thickness** extent deposition of the **optical transparent membrane 4** which can be formed at the temperature below the heat softening temperature of the transparence resin". Furthermore, Isokawa states in paragraph 0012, "Then, as shown in drawing 2, perform revolution spreading using the spin-on glass (SOG) used for flattening of the interlayer insulation film of a semi-conductor etc., it is made to sinter at the temperature below the heat softening temperature of a lens resin ingredient, and an **oxide film 5** is obtained. Drawing 2 shows the lens

configuration after carrying out deposition formation of the oxide film 5 by SOG on the substrate micro lens 3 in this way. According to this approach, the gap section produced conventionally disappears mostly and the micro lens of the rate of high condensing can form easily." Finally, Isokawa states in paragraph 0013, "In order to form an oxide film 5 by revolution spreading on the substrate micro lens 3 so that this drawing 2 may show, an oxide film 5 does not turn into isotropic membrane formation, but the thickness **TOX2 of the oxide film 5 formed in the gap section between lenses is thick**, and the thickness **TOX1 of the oxide film 5 formed in the crowning of the substrate micro lens 3 has the membrane formation property which becomes thin**. Thereby, the curvature of a final micro lens becomes larger than the substrate micro lens 3.

12. As for **Claim 13**, Isokawa discloses that the transparent layer (4) covering the plurality of lenses (3) is of uniform thickness (0.5 micrometers). The aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent membrane/oxide film (4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6) distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

Although, Isokawa does not specify a ditch depth, it is apparent that the ditch depth is at least 0.5 micrometers to avoid an unduly thickening of the transparent layer, wherein 0.5 micrometers meets the ditch depth requirement range of 0.05 micrometers and 1.5 micrometers.

13. As for **Claim 15**, Isokawa discloses that the transparent layer (4) covering the plurality of lenses (3) is of uniform thickness (0.5 micrometers). The aim of Isokawa is to eliminate a thickness of the transparent membrane/oxide film (4/5) in the gaps (6) between adjacent lenses (3). Even though, the transparent membrane/oxide film (4/5) is applied at the same 0.5 micrometer thickness over the lenses (3) and the gaps (6), the transparent membrane/oxide film (4/5) is thicker (TOX2) in the gaps (6) and thinner (TOX1) on the lenses (3), because the gap (6) distance is only 1 micrometer in length. To alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6), Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3. Thus, an even undercoat layer (flat layer 2) can be applied to the lenses (3) and the gaps (6) with the same 0.5 micrometer thickness.

Although, Isokawa does not specify a ditch depth, it is apparent that the ditch depth is at least 0.5 micrometers to avoid an unduly thickening of the transparent layer, wherein 0.5 micrometers meets the ditch depth requirement range of 0.05 micrometers and 1.5 micrometers.

Furthermore, it clear that the uniform thickness (0.5 micrometers) of the transparent layer (4) is outside the required range of 0.01 micrometers and 0.3 micrometers. According to the pages 11 – 14 of the specification, the required range of 0.01 micrometers and 0.3 micrometers is preferable because it allows easy formation of the transparent layer (4) over the lenses (3) and it reduces costs in manufacturing.

Isokawa discloses a method of manufacturing that allows for an easy formation of the transparent layer (4) as indicated in paragraph 0005: "Although condensing capacity is acquired by forming, in order to raise the rate of condensing by the micro lens more, it is required to make smaller the gap G between each lens shown in drawing 6 ... even if a gap G is small, it is needed about 0.8 micrometers with the constraint at the time of forming the sun-lit layer pattern for micro-lens formation with a photolithography technique ... configuration control in case it being stabilized and forming a tooth space on the resolution at the time of photolithography about the gap of 0.8 micrometers or less to the sun-lit layer which is a **lens ingredient makes whom of the pattern circumference difficult carry out** and **according to heat treatment more than subsequent heat softening temperature generated is dramatically difficult** ... This invention was made in order to cancel the above-mentioned trouble in the manufacture approach of the conventional micro lens, and it aims at offering the manufacture approach of the micro lens for solid state image pickup devices which the gap between lenses was vanished and made the rate of condensing high more."

Since the method of Isokawa is also designed for ease in formation of the entire device including the transparent layer, which is the same aim as the Applicant, the Examiner believes the required range (0.01 micrometers and 0.3 micrometers) is a matter of design of choice by the Applicant. Finally, the Examiner believes low cost manufacturing is an inherent objective of engineering.

15. As for **Claims 3, 6, 8, 11, and 14** (see objection above, as appropriate), the aim of these claims is to limit to a range or upper limit the gap distance between adjacent resin lenses so as fall within a range of 0.005 micrometers and 0.3 micrometers and not to exceed an upper limit of

0.6 micrometers. The Applicant chooses these limitations so as to satisfy the objective of preventing an unduly thick transparent resin layer in the ditches between adjacent resin lenses. It also the aim of Isokawa to alleviate the problem of a "thickening thickness" of the transparent membrane/oxide film (4/5) in the gaps (6) by etching ditches in the undercoat layer (flat layer 2), as shown in figure 3. Isokawa accomplishes this by only applying a transparent layer (4) covering the plurality of lenses (3) of uniform thickness (0.5 micrometers), wherein the gap distance between lenses is set to 1.0 micrometer. Since Isokawa achieves the aim of the Applicant's present invention using a gap distance that is outside the range and upper limit as required by the Applicant, the Examiner believes that the Applicant's requirements are merely design preferences.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The Examiner has cited numerous references on form PTO-892 and due to complexity of each reference the Examiner will not detail each one of them. However, regarding the cited references, the Examiner believes that forming a resin undercoat layer, a plurality of resins lenses arranged in a matrix, and a transparent resin layer of uniform thickness covering the plurality of resin lenses and the gaps between adjacent resin lenses are concepts well known in the art.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Justin P Misleh whose telephone number is 703.305.8090. The Examiner can normally be reached on Monday through Thursday from 7:30 AM to 5:30 PM and on alternating Fridays from 7:30 AM to 4:30 PM.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Wendy R Garber can be reached on 703.305.4929. The fax phone number for the organization where this application or proceeding is assigned is 703.872.9306.

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JPM
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WGarber
WENDY R. GARBER
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600